Implementation of the Patient-Health Questionnaire-9 (PHQ-9) Depression Screening Tool through the Nursing Discharge Process with Stroke Patients: A Quality Improvement Project

Presented in Partial Fulfillment of the Requirements for the Doctor of Nursing Practice in the Graduate School of The Ohio State University

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2020

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ABSTRACT

Introduction: Poststroke depression (PSD) is a common and detrimental condition affecting one-third of hemorrhagic and ischemic stroke survivors. Current guidelines recommend screening early in the stroke recovery period, with some suggesting it best to screen patients prior to discharge from the hospital. ***Purpose:*** The primary purpose of this qualtity improvement project was to determine if shifting administration of the inpatient depression screening from the stroke care coordinator to the nursing staff affected the number of overall missed (22.1%) and weekend-specific depression screenings (37%) for stroke patients at the author's institution. ***Methods:*** Total number of stroke admissions compared to the number of completed depression screenings, total number of depression weekend screenings, total number of positive depression screenings, and total number of psychiatric referrals were compared pre and post intervention. A Likert scale-based survey along with two open-ended questions were administered to the nursing staff to determine whether there was a change in nursing knowledge about post stroke depression in addition to acceptability, feasibility, and qualitative feedback about the process change. ***Results:*** No statistically significant differences were noted in the total amount of missed depression screenings (22.1% vs. 18.8%), the amount of missed weekend screenings for depression (37% vs. 15.6%), or the number of psychiatric referrals (4.7% vs. 4.7%) in the pre and post implementation periods. Nurses' knowledge about post stroke depression increased and the process change was well received. ***Conclusions:*** Administration of the depression screening by the nurses did not significantly change the number of overall or weekend depression screenings. The low number of positive screenings and psychiatric referrals in the immediate inpatient setting calls into question whether screening for depression this early is necessary and highlights the need for depression screenings at multiple points of care.

Keywords: Poststroke, stroke, depression, PHQ-9, screening, nursing, discharge

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Section I: Nature of the Problem

Introduction/Purpose

Depression is a significant global health challenge affecting 264 million people annually, worldwide (World Health Organization, 2020). Depression prevalence rates seem to vary with age and gender after stroke. Approximately, 5.5% of middle-aged to elderly males (55-74 years of age) and 7.5% of older females were diagnosed with depression after stroke (World Health Organization, 2020). On average, someone in the U.S. has a stroke every 40 seconds and someone dies of stroke approximately every four minutes (Mozaffarian et al., 2016). It is estimated that 2 million brain cells die every minute during a stroke. After a stroke episode, new brain cells form to compensate for the injury and form specialized contacts with other cells. These new connections may not always be functional or communicate properly with neighboring cells and other brain structures. The cascade of changes within the brain poststroke is associated with both poststroke recovery and risk for developing poststroke depression (PSD) and other neuropsychiatric disorders (Ferro, Caeiro, & Figueira, 2016).

Depression can develop from several internal and external factors. Strokes can produce intense depressive symptoms during recovery and persist indefinitely unless adequately treated. Stroke survivors are typically sent to a rehabilitation facility or home after their acute care admission. It is important that the initial acute care facility screens individuals for symptoms of depression to compare screening results to their evaluation in the post-discharge period. Those who are not screened and provided further care related to psychological well-being often have higher rates of functional decline like disability, sleep disorders, poorer rehabilitation outcomes, cognitive impairment, social withdrawal and isolation, and a weaker overall outlook in all-cause mortality (Burton & Tyson, 2015; Hackett & Pickles, 2014; Jyotirekha & Rajanikant, 2018). Strokes often leave patients with varying neurological focal deficits like memory loss, speech pathologies, and physical weakness that interfere with their original activities of daily living. These changes may lead to feelings of helplessness, frustration, and depressive sequelae that substantially affect a person's recovery. It would be wise to use a depression-rating scale to increase diagnostic accuracy in targeting depression as it is often confused with varying neurological deficits such

as general fatigue (Dar et al., 2017). The initial PSD screening is the starting point for working toward improvements in depression after stroke and ongoing management.

Both major depression at six months and elevated rates of mortality at 12 and 24 months have been predicted by early stroke related symptoms of depression within the first few weeks following mild-moderate stroke (Li, Oakley, Li & Luo, 2018). Even so, the general prevalence of depression maintains at about 1/3 of all stroke survivors. This is important considering PSD is associated with poor functional outcomes, behavioral and cognitive changes, and increased caregiver stress/burden (Towfighi et al., 2017; Wang, Meyer, Graham & Whooley, 2018; Hackett & Pickles, 2014). Along with psychological insults that result from suffering a stroke, physical deficits multiply the anxiety and frustrations of daily living upon returning home from the hospital. If patients are not connected to resources after discharge from an acute care facility, many may fail to adapt to their new circumstances. Those with physical deficits, such as weaker limbs, loss of sensation, visual disturbances, balance trouble, and lack of mental clarity, may realize that they cannot live and complete the same lifestyle as efficiently as they once did before their stroke (Matsuzaki et al., 2015). In addition, those who suffer from PSD may be at risk forrecurrent stroke. A meta-analysis that examined 753 research articles included six final articles for analysis after completing exclusion criteria. It was discovered that stroke survivors who had PSD had a 48% higher risk of recurrent stroke suggesting that early measures to treat PSD could also help decrease recurrence of stroke (Wu et al., 2019). It has been suggestedthat stroke patients should not only receive routine depression screenings during their rehabilitation, but also prior to discharge from the original acute care hospital so they can receive the support needed (Lanctot et al., 2019; McIntosh, 2017).

The setting for the following quality improvement (QI) project took place in a large, midwestern, comprehensive stroke certified and level II trauma facility with 381 private rooms. The facility admits 30-60 stroke patients a month (SCC Stroke Admission Data, 2019-2020). Regarding the prior process for PSD screening, the stroke care coordinator (SCC) was tasked with implementing the depression screening tool to all patients who suffered either a hemorrhagic or ischemic stroke during their admission prior to discharge from the hospital. Although the SCC had been successful at implementing the screening process, many screens were missed, particularly during the weekends when the coordinator was not scheduled to work and would not develop a daily stroke patient list. Theoretically, if a patient were

admitted late Friday for a stroke and discharged late Sunday, the SCC would have had no knowledge that the patient was admitted and would not have been screened for depression. Any medical professional including but not limited to social workers, physicians, nurse practitioners, physician assistants, case managers, and nurses who were trained in the knowledge of the PHQ-9 may administer the question set.

To improve upon these missed opportunities to screen for depression, the following project details a plan to have the neuroscience nursing staff (NSRNs) implement the screenings as early as their patients are functionally and cognitively able prior to the patient being discharged from the hospital. The following objectives for the project included: 1. Decreasing the number of overall missed and weekend-specific PHQ-9 screenings for stroke patients at the current facility; 2. Improving nursing knowledge of poststroke depression symptoms; 3. Increasing the number of patients who receive psychiatric referrals for depression prior to discharge; and 4. Obtaining staff feedback through surveys regarding the pros and cons of the PHQ-9 screening tool. With mandatory education provided to the NSRNs, stroke patients were routinely screened for depression before discharge throughout the week. In summary, the purpose of the clinical inquiry regarding PSD screening was to investigate how transitioning the role of PSD screening from the SCC to the NSRNs would affect overall rates of screenings and to offer recommendations regarding the importance of screening and its usefulness in the recovery process after stroke.

Section II: Review of the Literature

Problem Statement

PSD is a prevalent and detrimental aspect of survivorship. Although evidence exists demonstrating the potential for developing depression within the first weeks following stroke, the ideal timing to initiate screening remains unclear (Lanctot et al., 2019; Zhao et al., 2018; Wang, Meyer, Graham, & Whooley, 2018; Karamchandani et al., 2015; McIntosh, 2017; Powers et al., 2018). Despite inconclusive evidence defining a need to screen for depression in the acute care setting, an efficient screening process may still prove worthwhile in detecting a trend in depressive symptoms prior to being discharged to either rehab or to the community. The following PICO question addresses the problem and guides the basis for change: In persons recovering from an acute hemorrhagic or ischemic stroke (P), how does implementation of the PHQ-9 depression screening tool through the NSRN (I) compared to

implementation by the stroke care coordinator (C), affect the number of depression screenings, nursing knowledge of PSD symptoms, psychiatric referral rates, and provider satisfaction (O)? By using the neuroscience nurses, screenings were provided seven days a week to improve screening consistency and to hopefully ensure all patients are screened and receive an appropriate evaluation when warranted. Outcomes were measured through statistical comparison between the SCC's 2019 screening data and the NSRNs 2020 data.

Summary and Evaluation of Literature

The following databases were utilized to perform the literature review: CINAHL, PubMED, Cochrane, and Embase. Searches included the following keywords/phrases: "Nurs*," "Stroke," "PHQ-9," "Stroke," "Depression," "Screen*," "Post-stroke," "Tool," and "Assess*." Such wording was mixed and grouped in several ways to yield the best search result outcomes. The following outcomes were reported: "Post-stroke patients AND Screen* AND Depression AND Nurs* = 10 results," "Post-stroke patients AND Screen* AND Depression = 54 Results (Last 5 Years = 27)," "Stroke patients AND Screen* AND Depression AND Nurs* = 52 Results (Last 5 years = 20)," and "Stroke patients AND Screen* AND Depression = 276 (Last 5 Years = 155)." Roughly 66 sources were saved that pertained to the relevant problem including National guidelines, research articles, systematic reviews, meta-analyses, and general literature reviews. Summarized below in Figure 1 and Figure 2 are the twelve primary articles that provided adequate evidence to support the need for efficient and consistent depression screening in poststroke patients within the acute care setting.

Guidelines

Several guidelines exist for PSD that slightly vary in recommendations for the use of depression screening in stroke patients. The Adult Guidelines for Stroke Rehab and Recovery from The American Heart Association (AHA)/American Stroke Association (ASA) recommends (class 1, level of evidence B) screening for cognitive deficits in all stroke survivors prior to discharge home (Winstein et al., 2016). Depression may develop because of these cognitive deficits and screening may identify a patient's susceptibility for future depression. Although the guidelines represent individuals who are already present at rehab facilities due to stroke, it would be beneficial to screen individuals prior to discharge from the original acute hospital to address additional depression related needs prior to arriving at rehab. Through

the use of the AGREE II appraisal tool (*Appendix C*), the guideline was given a score of 87%, which is based off of several factors to determine the strength of support for the guideline.

Evidence was updated in 2018 within the AHA/ASA guidelines for early management for acute ischemic stroke, which recommends class 1, level of evidence B-NR for the administration of a structured depression scale to routinely screen for poststroke depression, but the optimal timing of screening is uncertain (Powers et al., 2018). Class 1 evidence is defined as having the strongest benefit to risk ratio and is highly recommended for use as part of stroke care. A level of evidence scored as, "B-NR," is defined as having moderate quality evidence from one or more non-randomized, well-designed and well-executed studies, which may include meta-analyses. Using the AGREE II appraisal tool, the guideline was rated a 92%.

Aside from the AHA/ASA guidelines for stroke care, the China Guidelines further described the importance of PSD. A correlative study conducted in China found 34.21% of stroke patients suffer from early onset PSD (Less than 2 weeks poststroke) (Zhao, et al., 2018). They explained that PSD symptoms occur parallel in stroke possibly because of direct brain injury or acute psychosocial response to stroke, but poststroke depressive disorder results from longer stroke sequelae that usually occurs closer to 6-months poststroke. The China Guidelines detail that stroke symptoms should be assessed early after stroke to help track the eventual development of depression as a diagnosis. The Guidelines also explored the PHQ-9 as a valid screening tool for depression in stroke survivors, finding 91% sensitivity and 89% specificity with a cutoff score of 10. They recommended the PHQ-9 as a valuable and easy to administer tool for early screening of major depressive disorder and PSD. The AGREE II appraisal resulted in a score of 90%.

In addition, the Canadian Stroke Best Practice Guidelines (CSBP) recommend that all people who have experienced a stroke should be screened for depression given the high prevalence of PSD (Level B) and the amount of evidence for treating symptomatic PSD (Lanctot, et al., 2019). They add that screening for PSD may take place at various stages in stroke care especially at transition points as time of onset can vary. The first stage is during the transfer from an inpatient acute care setting to rehab, the second is during rehab prior to returning to the community and lastly, during regular scheduled follow-up visits in the outpatient clinic setting. Our acute care hospital follows a similar recommendation for screening as

the initial screen occurs prior to discharge from the inpatient facility and screening is continued at follow-up appointments with neurology as warranted. That said, the CSBP specify that ideal timing for screening is unclear, so it is best to provide repeated screening as needed at any level. The AGREE II appraisal resulted in a 90%.

The National Institute for Health and Clinical Excellence (NICE) and the Royal College of Physicians (RCP) National Clinical Guidelines recommend routine assessment and management of mood and cognition after stroke. Similar to the CSBP, they recommend depression assessment using a standardized measure on at least three occasions including 1) Just before discharge or one month after stroke or at six-week follow-up; 2) Three months after stroke; 3) and six months after stroke (Gillham & Clark, 2011). They add that all stroke patients should be assessed for a mood disorder with simple, brief standard measure including the PHQ-9, which maintains alignment with the tool used in our current hospital system. The AGREE II appraisal score was 89% for this guideline.

Literature Review

Validation and evidence for the support of poststroke depression screening were addressed through guidelines that validated the use of different screening tools like the PHQ-9 (Figure 3) and articles that justified screening prior to discharge from acute inpatient facilities. Figure 1 shows an evaluation table of the evidence supporting use of PSD screening. One retrospective study demonstrated validation for screening through an early screening protocol provided by the nursing staff. The study discovered that of the 79 patients screened with the PHQ-9 between 0 and 7 days of admission by the neuroscience staff nurses, 48% were depressed (McIntosh, 2017). Unlike the previously mentioned study, the current facility was already implementing its own protocol, and the nurses were aware of depression screening from knowledge attained during annual stroke education. Allowing the nurses to implement the screening would potentially improve consistency by increasing the number of people available to screen these patients as opposed to one stroke coordinator.

Although not everyone develops symptoms in the immediate poststroke period, the use of the efficient PHQ-9 should not be excluded. Another study not only emphasized the benefit for early screening but showed that PSD is not an exact science and patients need routine follow-up and screening for several months following their stroke. Researchers showed that 42.43% of screened-positive

individuals identified at inpatient rehab were clinically depressed six months later while at home during follow-up according to DSM-5 criteria for depression (Lewin-Richter, Volz, JÖbges, & Werheid, 2015). In addition, regression analysis showed that those with early depressive symptoms had a 43% increase for moderate depression at six months post-assessment. The earlier the healthcare team can begin the screening process, the better the chances of successful management of depression further along in the poststroke period. Although the above study used the General Depression Scale-15 (GDS-15) rather than the PHQ-9 and they did not assess patients in the acute inpatient setting poststroke, it shows that early depressive symptoms have a high chance of progressing to depression several months after being observed.

Further, there is evidence suggesting PSD is best treated when pre-scheduled follow-up appointments are created in the immediate inpatient setting. During a retrospective comparison of stroke patients with the former group being from 2010 and current from 2012, researchers discovered that the addition of a pre-scheduled follow-up visits allowed for a higher percentage of patients to disclose information pertaining to mood (Berg, Hujala, Kari, & Tapiola, 2018). In the 2010 stroke group who did not receive any pre-scheduled follow-up appointments, less than 36% of patients expressed depressive symptoms up to their regular 18-month follow-up whereas those in the 2012 group showed that 77% of patients disclosed depressive symptoms within the same follow-up period. Researchers showed that routine screening after stroke can lead to greater diagnoses for PSD and pre-scheduled follow-ups help to assess individuals for symptoms of depression. Although the study largely examines patients months after their stroke, it emphasizes that routine depression screening is beneficial in this population. Even so, other studies have been able to demonstrate the potential need for early screening after stroke during an inpatient stay.

Risk factors for PSD include but are not limited to the severity of the stroke, prior mental health issues, age, pre-morbid neurotic personality traits, social isolation and substance abuse (Babkair, 2017; Das & G.K., 2018). As most patients who suffer stroke develop at least one of these risk factors, it is essential that survivors are screened early to assess for depressive symptoms and any other concerns pertaining to their recovery. Not only does a person’s previous psychiatric history and personality traits affect the potential for PSD, but demographics and socioeconomic status also influence their risk. One

study that examined the predictive factors associated with PSD showed that of 546 stroke survivors, 17% were diagnosed with depression upon screening with the PHQ-9 tool (Hirata, Ovbiagele, Markovic, & Towfigi, 2016). Interestingly, after adjusting for sociodemographic variables, those who were impoverished and had three or more medical comorbidities were also associated with higher odds of PSD. PSD is influenced by many variables and factors outside of solely a stroke itself. Each of these other variables may contribute to the differences that patients experience regarding the timing and severity of depression after stroke.

Regardless of timing, The US Department of Veterans Affairs and the Department of Defense Clinical Practice Guidelines for the Management of Stroke Rehabilitation recommend that all patients complete depression screening with trained individuals while using valid screening tools (Rogers, 2017). As no strict evidence showed that screening was most beneficial in the acute phase of PSD, no evidence refuted that such early timing was incorrect or detrimental to a patient. Evidence suggested that the PHQ-9 was an effective and non-disruptive form of screening regarding nurse work-flow. If patients were not screened prior to leaving the hospital, they could have been living with depressive symptoms for an unknown period without the resources available to seek appropriate psychiatric treatment.

Although there did not appear to be a specific tool created for screening stroke patients in the acute poststroke phase, it remained not only feasible but helpful to use the PHQ-9. A systematic review studied 27 tools that exist for detecting depression after stroke. The most effective tools were categorized into three groups such as verbal self-report, the use of visual aids and observational tools. The PHQ-9 was among the most popular and well validated with strong clinical utility and possessing the best ability to detect severe depression (Burton & Tyson, 2015). Unfortunately, the review aimed to uncover the ideal cut-off scores for each of these tools in detecting PSD, but too many variables like using a broad cultural population with key differences in interpreting depression could have affected appropriate scoring thresholds.

A meta-analysis of 24 studies found several screening tools with high sensitivity for detecting PSD, including the PHQ-9 (Meader, Moe-Byrne, Llewellyn, & Mitchell, 2014). Of the 24 studies, there were 552 patients from three studies that used the PHQ-9 to identify depression after stroke. Compared to the other eight screening tools, the PHQ-9 tied for the highest sensitivity to detect any depression (86%) and

tied for 5th for the highest specificity. Like most of the other studies, it was rated, "Fair," for ruling in clinical utility and, "Good," for ruling out the clinical utility regarding any depression.

Further validity is observed through a study conducted in the Thai population who used a translated Thai PHQ-9 to screen for depression in poststroke patients. A primary reason for using the PHQ-9 for PSD was because of the high sensitivity for depression and its ease of availability and translation into the Thai language. The study examined 115 patients comprising 63 males (54.8%) and 52 females (45.2%), with a mean age of 64 years. These researchers graded depression by assessing the previous two weeks for depressive symptoms. Overall, the mean Thai PHQ-9 score was 5.2 +/- 4.8 and according to DSM-5 criteria for depression, 11 patients (9.6%) were diagnosed with depressive disorder, 12 patients (10.5%) were diagnosed with adjustment disorder with a depressed mood and the rest of the 92 patients (80%) were normal (Dajpratham et al., 2020). Of those in the depressive disorder group, eight (6.9%) were classified as having a major depressive disorder (MDD), two (1.7%) with an unspecified depressive disorder, and one (0.9%) with another specified depressive disorder. It was determined that the PHQ-9 had acceptable properties for detecting a mixture of major depression and adjustment disorder in poststroke patients with a cutoff score of 6 signifying poststroke depression.

Though the PHQ-9 is well-validated and widely used for depression, its true use maintains alignment with the DSM-V and asks patients about depressive symptoms within the previous two weeks. Researchers assessed 158 ischemic and intracranial hemorrhage patients after excluding those with any pre-existing medical conditions or language deficits. Instead of assessing patients for depression within the last two weeks, they modified the PHQ-9 to explore depressive symptoms during the immediate poststroke period with an average screening being performed within 2.5 days of admission (Karamchandani, 2015). During this modified period, the researchers maintained that roughly 1/3rd of all patients screened in the immediate poststroke period were depressed.

Although other newer stroke depression-specific screening tools are being developed, the familiarity, validity, reliability, and efficiency of the PHQ-9 was suitable for the current population. One study that compared four depression tools through rigorous analysis examined the PHQ-9 and PHQ-2, the Hospital Anxiety and Depression Scale (HADS) and the GDS-15. Ultimately, the PHQ-9 presented the best balance of both sensitivity (81.8%) and specificity (97.1%), respectively (Prisnie et al., 2016). Other

researchers found that when comparing four different depression screening tools among 147 acute poststroke patients, the PHQ-9 showed a specificity of 87% (Wang et al., 2018). Although many other screening tools exist, the PHQ-9 consistently ranks among one of the most accurate and efficient tools for the poststroke setting.

In addition, a prospective study from the Netherlands examined the PHQ-2 and PHQ-9 in 164 stroke patients who met the following inclusion criteria: healthy enough for testing, signed informed consent prior to discharge, absent of cognitive difficulties, fluent in English and Dutch, and did not present any psychiatric comorbidities (de Man-van Ginkel et al., 2012). Subjects were established originally at baseline (T0) and included anyone who met the inclusion criteria and suffered either an intracerebral hemorrhage or cerebral infarct. At 6-8 weeks poststroke (T1), patients were provided the PHQ-9 by the nurse followed by the composite international diagnostic interview by the lead researcher who was absent during the PHQ-9 administration. Of the 164 poststroke patients, 20 were diagnosed with depression. The PHQ-9 was most accurate with a cut-off score for depression ≥ 10 with specificity and sensitivity in this setting resulting as 0.78 and 0.80, respectively. The PHQ-2 was most accurate at a cut-off ≥ 2 with specificity and sensitivity at 0.76 and 0.75, respectively. Regardless of its use for screening or specifically identifying depression in the stroke population, the PHQ showed adequate ability to reveal depression.

One study included a depression screening assessment that the researchers self-developed. This assessment tool was loosely derived from several validated tools and common symptoms observed in those diagnosed with PSD. The researchers tested their tool on 122 stroke survivors who met the criteria for depression according to the DSM-5 booklet. They accurately identified up to 36% of the sample and detected early symptoms of PSD within 14 days of the stroke occurrence (Li et al., 2016). The timeframe after stroke becomes increasingly important as some patients will attend inpatient rehab following their acute admission. It has been hypothesized that depressive symptoms become reinforced upon transitioning from inpatient rehab back into their home as personal awareness increases regarding the negative effects on a patient's original everyday life.

Critical Appraisal of Evidence

Figure 2 shows the synthesis and levels of evidence for the articles describing the importance of PHQ-9 pertaining to PSD. Unfortunately, despite a fair amount of literature discussing PSD, there is not

overwhelming support for high levels of evidence. Despite recommendations from the AHA/ASA, CSBP, China Stroke Guidelines, NICE and RCP to screen new stroke patients as early as possible, there is not a definitive protocol on the exact timing and ideal personnel needed to conduct the screening (Mitchell, 2015). Primary support for screening exists through the literature that explains the high prevalence of PSD and the need to establish psychiatric or neurological resources early in the plan of care (Meader et al., 2014; Wang et al., 2018; Choi, Tate, Rogers, Donahoe, & Hoffman, 2016). Seven of the twelve articles represent level III evidence with the remaining five articles including two articles each at levels IV and I and one level V article.

To maintain an updated discussion, evidence was obtained from the previous five years to 2015. Only two of the twelve primary articles were published at an earlier date from 2012 and 2014. Each of these investigated the use of the PHQ-9 on stroke patients and showed its ability to be used as a valid tool. All studies included only adult subjects who suffered from stroke and eight of the twelve studies used the PHQ-9 as the intervention. Since the articles used adult stroke patients and half of them represented findings within acute care facilities, the evidence is generalizable to the adult stroke patients being used in this QI project. The general body of evidence supports the use of the PHQ-9 in stroke patients but the definitive benefit and appropriate timing in screening patients in the acute setting remains unclear. Of the 12 articles, only four described direct use of RN staff to administer the PHQ-9 while the remaining articles either did not describe personnel who administered the test or presented data pulled from previous charts.

Though screening demonstrates the ability to identify those who have or are susceptible to depression, researchers and clinicians want to know if it produces any change to the outcomes of depression. Recent evidence has shown that anyone susceptible through the screening process should have a management pathway that provides the patient with psychiatric professionals in the hospital and in outpatient clinics (Towfighi et al., 2017). The current use of screening at the facility triggers either depression education and providing patients with stroke resources or the nurse to contact the attending physician depending on the PHQ-9 score. The nurses were already aware of the consult process and were trained to follow an algorithm (*Appendix B*) to contact the provider or to present resources.

Considering the high prevalence of PSD, it is reasonable to recommend its regular assessment and management in patients who have a stroke history, although causal mechanisms underlying associations with adverse outcomes require further clarification, as does the extent that interventions might modify risk elevation (Cai, Mueller, Li, Shen, & Stewart, 2019). The institutionally driven intervention to screen for depression in stroke patients, which is based off recommendations mostly from the AHA/ASA guidelines, maintains alignment with the current literature recommendations. RNs (when appropriately trained) are capable of implementing the PHQ-9 tool, the tool is valid for use in screening for PSD in stroke patients, and the earlier the identification of PSD, the earlier psychiatric care can be applied when warranted.

Gaps in Evidence

Although several articles and guidelines exist demonstrating the importance of using the PHQ-9 to assess for depression in stroke, only a small amount of literature focused on the delivery pathway of the screening tool. If the individual is a healthcare worker who knows how to interpret the scoring and who to consult for further evaluation, it seems valid for a variety of healthcare backgrounds to implement the tool, including nurses (McIntosh, 2017; Mitchell, 2015; Rogers, 2017; Dajpratham, 2020; DeMan-van Ginkel, 2012). The Joint Commission (TJC) has recently updated their inclusion criteria regarding comprehensive stroke certification (CSC). In their recent report, they have eliminated the absolute requirement for depression screening during the acute care setting (The Joint Commission, 2018). It remains a firm recommendation but strict depression screening is no longer a primary marker for certification. This change is likely for the variety of organizations who may present several forms for the assessment and screening for depression and or cognitive decline. Instead of strictly requiring a depression screen prior to discharge, they placed the assessment under an umbrella of important issues pertaining to psychological well-being. This allows institutions to maintain their assessment tools and protocols while still meeting the criteria for CSC. Associations like the AHA and ASA both show support for its significance and recommend its use, but screening may not be as time sensitive and not change process of care.

Theoretical Framework

The Tidal Model theoretical framework (*Appendix D*) is a mid-range nursing theory developed primarily as a guide for practitioners to aid patients who have suffered an incident that has adversely affected their mental health. It helps people recover their lives after experiencing a breakdown by reclaiming the personal story of their stress and difficulty (Barker & Buchanan-Barker, 2010)**.** As previously mentioned, a stroke patient's recovery is often more than regaining physical strength and overcoming aphasia. The psychological insult and potential for depression makes a patient as vulnerable as someone who may have suffered from drug abuse, a life-changing loss of a family member or any other circumstance that drastically alters one's original outlook on life (Barker & Buchanan, 2010). Implementation of the PHQ-9 is the first step in inquiring about a patient's story or their current mental health state.

Utility and Feasibility

The neuroscience nurses (NSRNs) were well prepared to implement the screening tool and make the appropriate consults. As a result, the SCC was able to spend more time putting together data and plans to improve other aspects of stroke care, including the upcoming development of a stroke team. In addition, there is no added cost burden for changing the delivery pathway of the screening tool, but potentially cost saving as the coordinator will gain time throughout the week to tend to other duties. Further, the development of the stroke team would generate more relative value units (RVUs) for the hospital by having an advanced practice provider regularly round on the stroke patients each day.

Time commitments were minimal and aside from the time RNs had to prioritize to implement the screening, only the SCC, the hospital statistician and RN leaders for each unit were required to prioritize some effort into the project through email correspondence, education, weekly screening audits, and data production. The nursing director provided final approval for the project to move forward.

Recommendations Summary

From the above literature review, no study directly compared depression screening outcomes in stroke patients among different types of providers. Most of the literature recommends that trained medical providers may effectively administer the PHQ-9 screening tool in stroke patients. Further, there is no ideal timing indicated to screen for PSD, but it should begin early in the poststroke recovery and be repeated a different time points during follow-up care (Winstein et al., 2016; Powers et al., 2018; Zhao, et

al., 2018; Kapoor, et al., 2019; Gillham & Clark, 2011). PSD affects between 12% and 72% of those who have suffered a stroke (Torrisi et al., 2018). Further, an updated systematic review with 28 new studies (Previous 51 studies totaled in 2005) found that 31% of stroke survivors developed depression up to five years after their initial stroke (Hackett & Pickles, 2014). Studies examining the prevalence of depression often present different time-points for its diagnosis, and PSD is case dependent, relying on many variables for its development. As previously described during the literature review, there was enough evidence from notable national guidelines and quality studies that showed the importance for depression screening in stroke patients.

Section III: Methods

Recommendations for Evaluation of an Implemented Evidence-based Practice Change

The hospital's neuroscience department previously utilized the SCC for all its depression screenings in stroke patients to maintain alignment with AHA/ASA guidelines for PSA screening recommendations. The SCC completed and tracked all stroke patients week-to-week. Although the SCC had been competent and successful in this endeavor, 22% of stroke patients went without being screened. This was largely due to the SCC not working over the weekend hours and being overburdened with too many stroke patients to interview on her own. With the SCC busy developing the stroke team and prioritizing time elsewhere, the NSRN staff could provide the PHQ-9 assessment, which would offer more coverage for screening in both the number of personnel available and the number of days present to provide screening. Depending on a patient's score, the NSRNs followed the PSD screening algorithm (*Appendix E*) to provide the necessary resources for depression if warranted.

Plan for Evaluation of the Evidence-based Practice Change

Evidence-Base practice Model

Evidence-based practice has evolved over the last 18 years from being the conscientious use of current best evidence in deciding about patient care to a broadened lifelong problem-solving approach integrating systematic synthesis of external evidence, one'clinical expertise, and internal evidence while respecting patient preferences (Melnyk & Fineout, 2015)**.** The John's Hopkins Nursing Evidence-Based Practice Model (JHNEBP) (*Appendix B*) is suited to work with the hospital's neuroscience unit as a scaffolding for the supported intervention.

The three phases of the JHNEBP include the practice question, evidence, and translation. The project was guided through the development of each phase. The practice question originally asked was, "Why are PHQ-9 screenings missed or filed as incomplete in poststroke patients within a stroke certified acute care hospital?" The scope extended as far as the NSRN's ability to assess all stroke patients. A formal project charter, schedule, risk management, and communication plan was developed to help organize and maintain the timeline for project implementation. Upon final synthesis and appraisal of articles based on the seven levels of strength of evidence, recommendations were proposed to the stakeholders regarding whether research was consistent, compelling, conflicting or entirely insufficient for ongoing testing.

Last, the translation phase of the JHNEBP used the findings from the evidence and allowed the team to determine the overall feasibility of how to implement the project with the specific patient population and the current timeline. The PHQ-9 is a short and rather easy tool to implement by NSRN. The tool did not affect the overall clinical processes already in place for discharging a patient, but added some additional charting and time along with any pertinent education about the results. Once the feasibility of the project was determined, resources were secured for subsequent implementation including: nursing staff support, education or training materials about the PHQ-9 and its delivery, and proper electronic medical record (EMR) charting. As the EMR already included a section for charting the PHQ-9, no other measures were taken to alter the current programs. Once the implementation was finished, an evaluation of screening compliance and nursing feedback surveys were completed, analyzed and disseminated.

Setting and Participants

The PHQ-9 was implemented through the NSRNs in a large, trauma level 2, CSC hospital. The hospital employs nurse practitioners, physicians, pharmacists, lab technicians, social workers, case managers, information technologists, registered nurses, and nurse managers among many other health care workers. The hospital admits between 30-60 total stroke patients a month. Most of the patient population comprises adults and families who are managed for acute illness and any accompanying chronic conditions. The participants specifically involved in this QI project included anyone admitted to the unit with a diagnosis ofstroke who was18 years of age or older from all ethnic backgrounds, socioeconomic, and education levels. Any stroke patient with aphasia, some form of dementia, or any

other variable that impeded the person's ability to provide accurate answers to the screening test were not excluded. These patients were collected as, "Unable to assess due to…," data. As, "Missed screenings," were being tracked, it was important to include these patients since screening could have been, "Attempted," but incomplete, which was not considered a, "Miss." Such patients were deemed, "Unable to assess," if they were not oriented to person, place, time and situation, too fatigued to engage in the assessment or clearly demonstrating some form of aphasic nature during routine neurological exams conducted by the NSRNs. Those who presented with inclusion criteria were discharged to a rehab facility that was determined through a combination of assessments from physical therapy, case management, and social work recommendations. If the inpatient facility could not screen patients because of their excluding symptoms, they were automatically logged in the EMR as, "Unable to assess," and followed with more specific psychiatric care with the immediate rehab facility when warranted.

Training

Prior to publishing the education module, the author attended leadership meetings and spoke with the nursing leads for the intensive, progressive, and intermediate care units. First, it was determined that the best way to brief the NSRNs of the change was to attend and present at three nursing huddles for day and night shift within each of the units. Next, since all NSRNs had the potential to provide care to a stroke patient, each nurse was instructed to complete a PHQ-9 education module. The education module was developed using pertinent evidence from the literature with guided images, an algorithm and competency quiz. The module provided not only education regarding PSD but also directions detailing how the nurses were to identify, chart and record the appropriate PSD scores. Nursing and education leadership teams provided feedback and offered edits prior to the module's launch to ensure accuracy of the material, grammatical correctness, and quiz questions.

The module was not published until final approval was acknowledged by the neuroscience nursing director. The module was launched as an electronic presentation through the hospital's education system, Healthstream. All NSRNs were required to complete the competency prior to administering the PHQ-9 screening tool. To ensure adequate completion, nursing managers were notified if a nurse did not complete the education within the designated three-week period. The PHQ-9 is known as an easy-to-learn tool that does not require an in-person training session and the use of excessive personnel for education

(de Man-Van Ginkel et al., 2012). In addition, NSRNs were notified through email when an education class expired or was incomplete. Further, nursing managers sent weekly updates to the NSRNs with reminders to complete the mandatory education. Documentation was recorded for the total number of NSRNs who completed the training and the results of the educational assessment. The huddle briefings and education module allowed sufficient guidance and support for the nurses to feel confident in proceeding with the new intervention.

Implementation

Implementation of the PHQ-9 depression screening tool began on 4/23/2020 after each NSRN completed the mandatory education module. Any patients who were already admitted and required a PHQ-9 screening assessment were covered by the SCC. Close communication between the SCC with nursing staff enabled an efficient transition to avoid missing any patients. The PHQ-9 was presented to all eligible stroke patients during the period after admission as soon as the patient was cognitively and functionally able to complete the screening form. Upon obtaining a score, nurses were guided by the established scoring system and algorithm to provide education, stroke support services or potentially notify the appropriate medical provider as shown in *Appendix E*. The current psychiatric referral process was previously established and continued as screening transitioned into a nursing responsibility. Upon completion of the screening, the nurses used the algorithm (*Appendix E*) to guide decision making for the best patient care. If nurses were unsure about how to score a particular response, he or she would contact the charge nurse, myself, or the SCC for any further questions. As a result, patients either spoke with a psychiatrist when warranted, or were provided with resources and/or additional referrals, and scheduled follow-up appointments. When a positive result for suicidal ideation occurred, a constant attendant was placed with the patient in addition to the psychiatric consult and suicidal precautions for the rest of his or her stay. Descriptive and quantitative data were collected along with two open-ended questions directed toward the nursing staff to obtain qualitative feedback pertaining to the change in the process of depression screenings.

Data was obtained and included the total stroke admissions, the total number of weekend stroke admissions, the frequency and total number of completed PHQ-9 screenings, the total number of completed PHQ-9 screenings over the weekend, the number of excluded or aphasic patients, and

psychiatric referrals completed during the data acquisition period (4/23/2020 to 7/31/2020). Data obtained through the new NSRN delivery pathway was compared to the original baseline from the previous year during the same months originally completed by the SCC. Pre- and post-analysis comparison of the data was completed as a part of the statistical plan.

In addition, further quantitative data was obtained through interpretation of Likert-scale statements provided to the nurses at the end of data collection within Healthstream. The survey was scored using a Likert-scale model for assessing the strength of the NSRN's feelings on a statement. The scale offered the following scoring levels for feedback: 1) Strongly disagree; 2) Disagree; 3) Neutral; 4) Agree; 5) Strongly Agree. Scores were totaled and assessed to reveal the overall impression of the nurses for each statement. Feedback from the nurses pertaining to the new intervention was identified through the following statements: 1) "The implementation of the PHQ-9 at discharge was easy to administer."; 2) The implementation of the PHQ-9 at discharge is beneficial for patients as a part of my practice as a nurse."; 3) "The implementation of the PHQ-9 at discharge offered accurate results."; 4) "I felt prepared to present the PHQ-9 to stroke patients."; 5) I feel confident in answering patient questions about the PHQ-9. "; and 6) I would recommend continuing the implementation of the PHQ-9." The raw quantitative data obtained from the screenings pre and post-test along with the Likert-scale survey and open-ended statements provided ample feedback regarding the ability of the new screening pathway to fulfilling consistent and efficient depression screenings in stroke patients.

Last, open-ended statements were provided to the NSRNs pertaining to the changes experienced. Nurses could freely describe their thought process and provide any feedback to the following statements: 1) "Please explain any difficulties, frustrations or any other problems that occurred while implementing the PHQ-9;" 2) "Please explain any alternatives to how the PHQ-9 should be implemented or provide any suggestions to improve upon the new intervention." These statements were provided as part of a post-implementation assessment within the Healthstream education system and each answer was stored and logged.

Potential Barriers, Organization, and Policy Driven Implications

As the project was conducted in a large hospital within an acute care setting, several barriers were anticipated. First, it was imperative that NSRNs be trained and aware of the depression screening process

change. The large volume of nurses who administered the screenings could have presented variability in the approach during an interview session. Although the same questions were asked, it was important that strict rules were followed. A nurse was not to convince a patient that one answer was better than another or help guide the patient to an answer. The nurse was to allow the patient to think about their own perceptions about their mental well-being and independently decide. If the NSRN was unaware of this specific training, answers and data might have been inaccurate.

There was not much resistance to implementing the PHQ-9 from the NSRNs. The explanation of the process at nursing huddles, presenting at annual neuroscience education classes, and developing a module for guidance improved the overall nurse, "Buy-in," to move forward with the intervention. Even so, nursing leadership posed many questions and requested explanations for some quiz questions in the education module. After working together to ensure that each nursing leader accepted the edits for the Healthstream module, the PSD education was published. It takes an average of 17 years to translate 14% of original research into a usable benefit for patients and an average of 9 years for interventions recommended as evidence-based practices to be adopted (Tinkle, Kimbell, Haozous, Shuster, & Grochowski, 2013; Melnyk & Fineout, 2015). Although the NSRN moved forward with implementing the new task, there was never a specific option to refuse the implementation. That said, the surveys and open-ended questions provided after data collection offered a way to value their feedback regarding the added task as a part of the team and improvement process.

Some studies showed difficulty obtaining consistent results when only using one form of depression screening, especially with patients who may exhibit some aphasic symptoms (Rogers, 2017; Robinson & Jorge, 2016). Accurate documentation regarding the patient's poststroke condition and level of consciousness was acquired. NSRNs were to only complete screening on stroke patients who demonstrated competent neurologic status as a result from routine neurologic exams, which included assessment of orientation and ability to communicate. They were to mark the screening as, "Unable to assess," even with the slightest evidence that a patient may not be able to communicate appropriately. Without proper neurologic assessment, it is possible that some NSRNs could have missed minor cognitive impairments that could have generated inaccurate screening results. To add to the difficulty, non-native English speakers were less likely able to participate in the screening process in the absence of an English-

speaking family member or certified language interpreter. The project site sees approximately 74.7% Caucasian, 22.9% African American, and 2.5% of other races, which often include many who do not speak English as their native language. Although the NSRNs were trained in how to contact interpretative services, language barriers impeded accurate results and the ability to conduct the PHQ-2 or PHQ-9. Also, the use of non-certified staff may have led to mistranslation, while use of friends and family members may have resulted in the patient under-reporting depressive symptoms.

Protection of Human Subjects

The following project was granted exempt status by the Institutional Board Review (IRB).

Data Collection/Evaluation

The educational module was opened via Healthstream for the nurses to complete for three weeks. Implementation of the project change occurred on April 4/23/2020. The NSRNs responsible for caring for poststroke patients executed a depression screening assessment using the well-validated PHQ-9. The stroke patient list was evaluated at least three days a week (MWF) by me for the duration of data collection to ensure compliance with charting the PHQ-9 on stroke patients. If I could not review the list, the SCC was available to check patient scores in my absence. Descriptive data was collected each week and included the total number of subjects screened out of eligible patients, the average day each patient was screened and any psychiatric consults that resulted from screening. Typical follow-up scheduling and processes continued but were not included in the project outcomes.

Data Analysis

Project analysis was conducted at the termination of data collection. It took approximately another two weeks to obtain the final data from the hospital statistician. From approximately 9/3/2020 to 9/11/2020, I along with The Ohio State University statistician facilitated the project analysis. Raw data from the pre-and posttest periods included the number of stroke admissions, the total number of completed PHQ-9 screenings, total stroke patients during the weekend versus the total screenings completed over the weekend (Saturday and Sunday), psychiatric referrals completed, the average day each patient was screened, and the number of those who could not be assessed because of symptoms like aphasia or confusion. Also, patients were recorded who demonstrated stroke symptoms without diagnosis

of an acute stroke but had a history of previous stroke. This data provided further insight regarding how many potential patients with prior stroke could benefit from depression screening regardless of acuity. Unfortunately, this data was only showed with the recent 2020 group and was not tracked during the previous year.

To assess the NSRN's feedback, quantitative analysis was completed using a Likert-based scale consisting of six statements administered to the nurses at the end of the data collection period regarding usefulness of the screening and overall opinion on the implementation change as previously described. Further nursing feedback was collected with two open-ended statements provided to the NSRNs that inquired about feasibility of the intervention and any alternatives that may improve the process.

The baseline data consisted of the patient's age, gender, type of stroke, length of hospital stay, and average day screened. Nursing demographics were also obtained during the Healthstream education session and included their gender, age, years working within the neuroscience unit, and work status as a single hospital RN, flex RN or travel RN. Baseline data, audit data and the questionnaire results were described using frequencies, means, standard deviations, and percentages. To compare differences among the patient groups, chi-square testing was used for categorical baseline data. Statistical software was be used to perform the quantitative data analysis and a $P < 0.05$ with a 95% confidence interval. Data from the nursing questionnaire were presented as numbers with the corresponding percentage of nurses who agreed with a particular item on the questionnaire. The questionnaire was analyzed using descriptive statistics.

Section IV: Findings

Results/Outcomes

Nursing Demographics

As previously noted, demographic baseline data was obtained by the NSRN to demonstrate nursing gender, age, years working and full or part-time status. Upon completing the Healthstream poststroke depression module, there were 107 RN responses for the demographic questions. Of the 107, 87 female RNs (81.31%), 18 males (16.82%), 1 non-binary AND 1 RN who chose not to disclose their gender status. Most RNs who took the education were between 26-30 years old (29 total; 27.10%). The remaining ages included 26 RNs up to age 25 (24.30%), 27 RNs between 31-40 years old (25.23%), 19

RNs between the ages 41-50 (17.76%), 5 RNs between ages 51-60 (4.67%) and only 1 RN above 60 years of age.

The NSRNs also demonstrated a less-experienced overall cohort, with most only having worked as an RN up to 3 years (54 RNs; 50.57%). Another 22 RNs had between 4-8 years of experience (20.56%), 16 RNs had between 9-15 years (14.95%), 4 RNs had between 16-20 years (3.74%) and 11 RNs had over 20 years of overall experience (10.28%). Last, data were obtained pertaining to employment status as either a flex RN, single hospital RN, or travel RN. As expected, most neuroscience RNs who took the PSD module worked only at the hospital using the new poststroke depression screening pathway through RNs. Of the 107, 97 RNs worked only at the hospital being studied (90.65%) and another 8 were flex RNs who worked at any of the three system hospitals designated between the data collection period (7.48%). There were only 2 traveling RNs who were stationed in the neuroscience unit during this designated time (1.87%). Refer to Table 1.

Nursing PSD Education Test Results

The PSD education module was required for all participating RNs. The average score was 84% (Healthstream Reports, 2020). The nurses had to take the test until they achieved at least an 80%. One hundred percent of nurses completed the education module and passed the competency test.

PSD Quantitative Statistics

2019 Data from Stroke Care Coordinator

For 2019, the average patient age was 65 years with 74 total males and 98 females. Of these patients, 31 were diagnosed with non-traumatic intracerebral hemorrhage and the remaining 141 were diagnosed with cerebral infarct. There were 172 eligible stroke patients that met criteria for the depression screening (NIME-73; NPUE-75; NIUE-24). Of the 172 patients, 134 (77.9%) were screened or attempted to be screened by the SCC, leaving 38 (22.1%) patients who were missed and never received an attempt at screening. There were 29 (16.9%) total patients unable to be screened due to factors like aphasia, confusion, loss of consciousness, or withdrawal of care. Further, of the 172 total patients, only 27 (15.7%) were discharged over the weekend (Saturday or Sunday) in 2019. Of these 27, 17 (63%) patients were screened and 10 (37%) were missed. For the 38 patients missed overall, 10 of these patients were missed

due to weekend discharges, or 26.3%. Last, there were 8 total psychiatric referrals (4.7%) either obtained directly because of screening or already pre-existing due to previous psychiatric history.

Other data included were the average PHQ-9 and PHQ-2 scores for each unit, and the average overall day patients were screened. For the NIME in 2019, the average PHQ-9 and PHQ-2 scores were 2.1 and 0.69, respectively; NPUE in 2019 average PHQ-9 and PHQ-2 scores were 1.1 and 0.28, respectively; and the NIUE in 2019 average PHQ-9 and PHQ-2 scores were 0. The overall average PHQ-9 score among all units was 1.05 and average PHQ-2 score was 0.32.

Regarding the average day of screening, NIME patients were screened on an average of 1.5 days out of their average length of stay (LOS) of 3.87 days; NPUE patients were screened on an average of 3.4 days out of their average LOS of 5.37 days; and NIUE patients were screened on an average of 9.4 days out of their average LOS of 11.4 days. Overall, patients were screened among all units on an average of 4.8 days out of their total average LOS of 6.89 days. Refer to Table 2.

2020 Data from NSRNs. For 2020, the average patient age was 70 years with 64 total males and 64 females. Of these patients, 22 were diagnosed with non-traumatic intracerebral hemorrhage and the remaining 106 were diagnosed with cerebral infarct. There were 128 eligible stroke patients for depression screening (NIME-63; NPUE-46; NIUE-19). Of the 128 patients, 104 (81.25%) were screened or attempted to be screened by the neuroscience RNs, leaving 24 (18.8%) patients who were missed and never received an attempt at screening. There were 10 (7.8%) total patients unable to be screened due to factors like aphasia, confusion, loss of consciousness, or withdrawal of care. Further, of the 128 total patients, 32 (25%) were discharged over the weekend (Saturday or Sunday) in 2020. Of these 32, 27 (83.37%) patients were screened and 5 (15.6%) were missed. For the 24 patients who were missed overall, 5 of these patients were missed because of weekend discharges, or 20.83%. Last, there were 6 total psychiatric referrals (4.7%) either obtained directly as a result of screening or already pre-existing due to previous psychiatric history.

For 2020, the average PHQ-9 and PHQ-2 scores for each unit and the average overall day patients were screened were obtained. For the NIME in 2020, the average PHQ-9 and PHQ-2 scores were 3.9 and 1.2, respectively; NPUE in 2020 average PHQ-9 and PHQ-2 scores were 2.2 and 0.53, respectively; and

the NIUE in 2020 average PHQ-9 and PHQ-2 scores were 1.9 and 0.86, respectively. The overall average PHQ-9 score among all units was 2.6 and average PHQ-2 score was 0.85.

Patients in the NIME were screened on an average of 1.8 days out of their average LOS of 3.42 days; NPUE patients were screened on an average of 2.2 days out of their average LOS of 4.15 days; and NIUE patients were screened on an average of 4.2 days out of their average LOS of 7.1 days. Overall, patients were screened among all units on an average of 2.7 days out of their average LOS of 4.89 days.

2019 and 2020 comparison data. When comparing the 2019 total screenings completed through the stroke care coordinator versus the screenings completed in 2020 through the neuroscience nurses, there was no statistically significant difference in the amount of missed screenings. There was a slight decrease in missed screenings from 22.1% to 18.8%, which demonstrated a minor improvement, but there were also 44 fewer patients screened in 2020. The overall *p* value was 0.56 for the data set.

When comparing the 2019 weekend data set (Pre) to the 2020 data set (Post) pertaining to discharges, there was a significant decrease in the amount of missed screenings from 37% to only 15.6%. There were also 5 fewer patients discharged on the weekend in 2019 compared to 2020 showing an overall *p* value of 0.08.

There were no significant differences in the number of psychiatric referral results from 2019 to 2020. Of the total stroke patients in 2019 (172) and 2020 (128), 4.7% of each group were referred for psychiatric consultation within the acute care setting, providing an overall *p* value of 0.99.

Last, a final comparison study investigated the percentage of stroke patients screened who generated a score above the cut-off value (PHQ-9 > 4) for suspected depression. In the 2019 group, there were 103 total PHQ-9 scores with only 13 patients (12.6%) who scored above a 4 warranting further notification of the attending physician or neurologist by the SCC. In 2020, of the 82 who received PHQ-9 scores, 18 (22%) of them scored greater than 4. There was no statistical significance between the two groups and the p value resulted in 0.11. Refer to Table 2.

Nursing Feedback results

Neuroscience nursing questionnaire post implementation. From 8/18/2020 to 9/11/2020, the NSRNs completed a Likert-Scale based questionnaire about the new PHQ-9 screening process. A total of 85 RN's completed the questionnaire. For each statement, the RNs had to choose from the following 5

answers and their respective scores to describe their feelings about the particular statement: 1- Strongly disagree; 2- Disagree; 3- Neutral; 4- Agree; 5- Strongly agree. Refer to Table 3.

Neuroscience nursing open-ended questions. The first statement: "Please explain any difficulties, frustrations or any other problems that occurred while implementing the PHQ-9," provided 30 answers out of 85 total RNs who submitted feedback. The second statement: "Please provide or explain any alternatives or improvements to the current screening process, provided 17 answers out of 85 total RN participants." Refer to Table 4.

Discussion

The PHQ-9 depression screening tool was implemented through the NSRNs to compare outcomes with the SCC who previously conducted PHQ-9 screenings. Outcomes were based on the previously mentioned four objectives to evaluate the change in process. Analysis revealed consistency with the literature as NSRNs were capable of effectively screening for depression in stroke patients using the PHQ-9; however, adjustments in the hospital's depression screening protocol could improve upon the lack of significance observed when comparing outcomes between the SCC and NSRNs.

When comparing the number of PHQ-9 screenings obtained out of the total number of acute stroke patients in 2019 to the number of screenings obtained out of the total number of stroke patients from 2020, there was no significant difference in the number of missed screenings (Table 2). Interestingly, there was clinical improvement in the amount of missed screenings during the weekend days (Saturday and Sunday) when comparing the NSRN data versus the SCC. Despite having 5 more stroke patients discharged over the weekend, the NSRN group missed only 15.6% of the screenings versus the SCC who missed 37% of screenings in 2019. Although there was not an overall significance in the percentage of missed screenings during the change in process, it is promising that the prior difficulty observed with screening over the weekend improved as intended.

As previously mentioned, until 2018, TJC recommended that depression screening be mandatory in stroke patients within the acute care setting after a stroke to maintain CSC (The Joint Commission, 2018). The Hospital's stroke program includes PSD screening as a part of its ongoing metrics as both the AHA and ASA still recommend screening as best practice but the timing is uncertain. Though the current change in process examined the ability to transition the PHQ-9 screenings from the role of the SCC to the

NSRN, it also demonstrated key findings that suggest screening may not be absolutely needed in the acute setting poststroke..

About 1/3rd of all stroke survivors develop depression after suffering a stroke related incident (Karamchandani et al., 2015; Bartoli, Di Brita, Crocamo, Clerici & Carrá, 2018; Burton & Tyson, 2015; Dajpratham et al., 2020; Hamid & MacKenzie, 2017). One study that observed the feasibility of depression screening in the acute care setting obtained results from 211 eligible patients with 75% of them being screened using the PHQ-9. The average time for screening was 2.5 days after admission. When comparing the researchers results with the current study, a similar number of stroke patients were obtained (174 and 128 from 2019 and 2020, respectively) and the average day screened was 4.76 in 2019 and 2.73 in 2020, similar to the researcher's 2.5-day average. The researcher's average PHQ-9 score was only 3 and the cut-off score for patients to be considered depressed was a score > 4. Even so, they mention that 1/3rd of all stroke patients screened were positive for depression, which aligns with popular data (Karamchandani et al., 2015). The current hospital system showed that only 12.6% of all patients screened in 2019 met the criteria for further work-up and potential psychological evaluation. A higher percentage of patients met the depression criteria in 2020, resulting in 22% of all stroke patients screened. The exact Pearson Chi-Squared test *p value* was 0.11 demonstrating no significant difference among the two groups for this study (Table 2). Though the above results do not represent 1/3rd of their respective groups for suspected depression, they still represent a clinically significant amount of patients who present an early depressive risk. In addition, the well-accepted statistic that states about 1/3rd of all stroke patients develop depression accounts for individuals up to a year after their stroke, not specifically within the acute phase of recovery (Hackett & Pickles, 2014). Though the overall PHQ-9 score averages were below the cut-off score for suspected depression, the frequency for depressive symptoms in the acute phase poststroke still demonstrated between 10 and 25% between the 2019 and 2020 data, making it difficult to recommend ridding of screening entirely in the acute poststroke setting.

Further exploration of alternative screening tools like the stroke aphasia depression questionnaire-hospital version (SADQ-H) and implementation of an embedded EMR notification to remind nurses to screen needs investigated. One China study examined 270 ischemic stroke patients through a prospective study conducted a little over a year. They initially obtained baseline data within the first two-weeks

poststroke including screening for depression with the stroke aphasia depression questionnaire-hospital version. A second assessment was completed at three months and a cut-off score of > 18 was used to determine PSD. Aphasia was determined using the Aphasia Quotient (AQ) rating. At baseline, 59.3% of patients demonstrated an aphasic symptom and the incidence of PSD was 47.5% compared to the non-aphasic patients who had an incidence of PSD of 29.1% (Wang et al., 2018). Those with aphasia at baseline had higher incidence of PSD at baseline and three months poststroke. The current hospital resulted with 16.9% and 7.8% of patients who were, "Unable to be assessed," due to aphasia or cognitive impairment in 2019 and 2020, respectively. The use of the SADQ-H could have shown greater incidence of PSD since these patients were unable to be properly assessed using the limited PHQ-9. Of consideration, the China study could not exclude the possibility that nursing staff were unable to distinguish between insomnia, irritability, poor appetite, anxiety and depressive symptoms, adding to the bias of PSD to an unknown extent.

Further, aside from considering the use of the SADQ-H, other tools like the well validated depression prediction scale (DePres) could offer an even more efficient, practical intervention for predicting the development of depression poststroke, specifically major depressive disorder. Given the decreasing length of stay stroke patients now experience in the hospital setting, a prediction instrument was designed by researchers (De Man-van Ginkel et al., 2013). Since depression symptoms are often difficult to discern from other stroke outcomes as previously mentioned, it was thought that a depression prediction tool would better serve as an intervention for those in the acute setting. Although the original developed DePres presented accurate outcomes, a recent study further investigated its accuracy for use (Hirt et al., 2020). Upon analyzing several variables associated with risk factors for depression after stroke, the DePres scale was created and included the following questions when assessing stroke patients: Does the patient have history of previous psychiatric disorders?; Does the patient have medical history of hypertension?; Does the patient have medical history of angina pectoris? And to what extent does the patient need help with dressing (part of Barthel Index)? Each of these is scored and totaled offering feedback about a particular patient's risk for major depression at approximately two months poststroke. The recent study had nurses assesse 93 stroke patients at baseline within the first week following stroke using the DePres. At 6-8 weeks poststroke, the patients were provided with a formal psychiatric interview

by a separate, blinded researcher to determine depression. They presented an overall prevalence of major depressive disorder in 18.3% of the patients. The predictive score for the DePres was best at a cut-off score of 0 (Specificity 0.74 and sensitivity 0.64) and results were comparable to the internationally known prevalence of major depressive disorder at 13% according to DSM V criteria within six weeks after stroke (Hacket & Pickles, 2014). The DePres is particularly useful as it does not require any patient interview and predicts depression soley from a patient's history and physical capabailites. Such a tool could mitigate the need for an additional nursing intervention like a patient interview, reducing resources required to assess for depression. Even so, the study excluded patients with cognitive and communicative impairments. Further screening with a tool like the SADQ-H would still need completed to evaluate all patients.

After such changes, if screening continues to demonstrate a lack of significance in identifying depression in the acute care setting, then removing the screening intervention should be considered. A future study that would track depression screening in stroke patients from the acute care setting and up to the first year poststroke would better identify the ability of the PHQ-9 or other screening tools to detect depression later in the recovery process of stroke.

The NSRNs did demonstrate increased knowledge of PSD and the process change was well received. Though the new process contributed more time and added an extra job to the NSRNs, most of them felt confident completing the intervention and answering patient questions regarding stroke recovery specific to depression.

There was no significant difference in the number of psychiatric referrals while in the hospital when comparing the SCC's data and the new neuroscience nursing data for 2020 (Table 2). The psychiatric evaluations were not always a result from the PHQ-9 screening score itself. Other psychiatric processes were present warranting a consult by the attending physician. Within the pretest group, five patients did not meet criteria to warrant an inpatient psychiatric consult, but their scores earned a psychiatric referral at the rehab clinic upon discharge. Another three patients refused psychiatric evaluation when their scores warranted a consultation by the SCC. For the posttest period 4/23/2020 to 7/31/2020, two of the six total psychiatric consultations were because of the patients having delirium, another three had previous history

of either major depression or bipolar disorder, and only one had a referral made directly because of a high PHQ-9 score (Score= 10).

Limitations

As implementation of the PHQ-9 depression screening tool progressed from the SCC's responsibility into the NSRN's role, there were some unavoidable limitations that altered the course of the process change. The biggest obstacle during the implementation phase involved the rapid changes associated with the SARS-Cov2/COVID-19 viral pandemic that occurred in Ohio beginning on March 9th when a state of emergency was issued by Governor Mike DeWine. Soon after, changes began occurring within the hospital to prepare the staff for the potential influx of positive SAR-Cov2 patients. Despite new education for nurses and staffing changes, the director for critical care services agreed to proceed with the transition of the PHQ-9 depression screen from the SCC into the nursing role.

The pandemic could have primarily affected NSRNs within the NIME, as 18 of the 33 beds were converted for COVID-19 patients beginning on 3/18/2020. Despite such changes, there were only 3 NSRNs who responded through the open-ended questions that the screening was difficult directly due to the onset of the COVID-19 pandemic (Table 4). At least another 10 RNs mentioned feeling overburdened or without enough time to complete the screening, which may have included aspects of the COVID-19 pandemic.

To further understand the impact from the pandemic, the hospital statistician provided data regarding the number of stroke patients who were also coded with a stroke diagnosis. Within the provided timeframe for the project (April through July 2020), there were 181 primary strokes (212 if trans-ischemic accidents (TIAs) were included). Of the 181, none were diagnosed with COVID-19. As a side note, about 2/3rd of COVID-19 patients were given the primary diagnosis of COVID-19 since it was so severe. When the stroke coding definition was filtered to include strokes coded at any position, not only primary, there were 233 strokes (265 including TIAs), 2 of which were also diagnosed with COVID-19. Even so, the same NSRNs who were taking care of standard neuroscience floor patients with stroke, were also taking care of the COVID-19 patients on the neighboring COVID-19 unit depending on their scheduled shift. Despite the low incidence of COVID-19 positive patients with stroke, NSRNs were still presented with direct involvement with COVID-19 patients and the stress that accompanied the transition.

Audits on stroke patients were completed at least three days a week to ensure reminders were provided to RNs who had eligible patients for screening. In addition, the daily stroke list was emailed to each NSRN lead and all charge RNs were provided with a copy of the list and those who still needed screening were highlighted on the list. Verbal reminders were also provided. Last, the charge nurses also added depression screening to the stroke order checklist, which was completed on every stroke patient.

These multiple layers of reminders is likely not sustainable. This barrier could be mitigated by integrating a notification in the EMR. RNs spend much of their time regularly charting and using the technology to remember medication schedules and new orders placed by physicians. One qualitative explorative study assessed nursing feedback regarding the usefulness of EMR alerts through nursing interviews. The majority of nurses confirmed that alerts and EMR notifications enhanced patient safety and templates or checklists that required nursing attention improved completeness of EMR notes (Tubaishat, 2019). For any known stroke positive patient, a push-style notification prompt/banner could be implemented to alert the patient's RN that he or she needs to screen a patient prior to discharge. A notification could prompt the RN at least once a shift until completed and logged.

Conclusions

The primary intention of the project was to observe the changes in screening frequency when transitioning the role of screening from the SCC to the NSRNs. This project demonstrated that shifting responsibility to the NSRNs resulted in no change in the number of overall depression screenings but did result in a mildly significant decrease in the number of missed screenings over the weekend. The institutionally driven project not only demonstrated that the NSRNs were effective at implementing the PHQ-9, but that the depression screening process needs further developed to include stroke patients with aphasia and an improved depression screening EMR alert system. This process will continue to be observed over time to detect any trends and include a larger population.

Another important finding from this project was the number of patients who screened positive for depression during the immediate poststroke period. Current guidelines recommend that these patients should be screened for depression during this timeframe (Yildirim & Ones, 2019). Additionally, current statistics show that one-third of stroke patients will develop depression (ref here). Despite these recommendations, both the pre and post data from this QI project showed that most of those screened in

the hospital in the immediate poststroke period did not present with PHQ-9 scores consistent with depression (Cut-off score > 4). This inconsistency suggests that either the depression has not yet developed in the course of the disease or the current screening tool that was utilized, the PHQ-9, did not capture this population.

The PHQ-9 tool is currently designed for those with symptoms that have persisted greater than 2 weeks. This is closely based off of the DSM V criteria for depression, which states that a person must experience five depressive symptoms nearly everday within the previous two weeks. As the average length of stay for the stroke patient data sets were 6.89 and 4.89 days in 2019 and 2020, respectively, the PHQ-9 would have been assessing for depressive symptoms prior to most patients' stroke incident. The PHQ-9 has shown validity in detecting depression when modified to ask patients' questions as they pertain to the time since their stroke (Karamchandani et al., 2015). Despite this, it remains difficult to know if their depressive symptoms started prior to the stroke or as a result of the stroke itself, especially as depression can often be confused with such conditions like apathy or fatigue.There are no current screening tools that have been shown to be valid and reliable indicators of depression over this short of a time frame. Although screening in the hospital does uncover patients who screen positive, the prevalence of these patients is often low, is often confounded by pre-existing mental health conditions, and rarely requires immediate inpatient intervention with a psychiatric provider. These findings question whether current guidelines should advise depression screening in the immediate poststroke period or if screenings should start in the outpatient setting.

Section Five: Recommendations and Implications for Practice

Implications for Practice

The project required professional collaboration and inquiry among healthcare providers, patients, hospital administration, extensive literature review and knowledge of patient care for those who suffered a stroke, comprehension of how stroke relates to depression, the screening tools available that help detect depressive symptoms, development of education for nurses, use of technology for data collection and efficiency, and overall implementation of a new process and evaluation of data collected. To adequately engage in the intervention, eight of the Doctor of Nursing Practice (DNP) Essentials were incorporated to demonstrate competent knowledge regarding depression screening in stroke patients.

Essential I includes the use of science-based theories and concepts to, “Describe the actions and advanced strategies to enhance, alleviate, and ameliorate health.” (American Association of Colleges of Nursing [AACN], 2006). This project used nursing theory and evidence-based recommendations for stroke care to attempt to improve the identification of depression in stroke patients. Essential II utilizes scientific findings in nursing to help develop and evaluate care delivery approaches that meet current and future needs of patient populations. The stroke population is susceptible to developing depression and the current project evaluated the care delivery of the PHQ-9 screening tool within stroke patients. In addition, efficient and advanced communications methods were used to guide the project forward and transition the screening role from the SCC to the NSRNs responsibility.

Essential III involved the use of analysis and ability to critically appraise existing literature to determine the best overall evidence suitable for practice. As previously noted, of the 66 total articles surveyed, 12 offered key interventions and methodologies that were synthesized to offer support for the project’s process change. In addition, the project included application of relevant findings to improve practice and used information technology to collect appropriate and accurate data for detecting depression in stroke patients. Essential IV primarily involves the ability to use information technology to effectively analyze, organize and evaluate patient data and health information. Patient EMR’s were used by the NSRNs to record PHQ-9 scores and these scores were tracked and transferred into software programs like Microsoft Excel for further conversion into meaningful data. Essential V, which pertains primarily to health policy development, did not directly apply to the following project. For essential VI, interprofessional collaboration, hospital physicians, nursing leadership and the nursing staff were regularly in communication with the project leaders during the transition of the PHQ-9 screening tool from the SCC to the NSRN’s responsibility. Although not necessarily a direct portion of the projects purpose, essential VII played a role in stroke education. Upon implementing the PHQ-9, NSRNs were to educate stroke patients on risk reduction and explain the risk factors associated with not only stroke prevention but also depression.

Last, a primary component of essential VIII encompasses advanced practice nursing such as the ability to demonstrate advanced levels of clinical judgement, systems thinking, and accountability in designing, delivering and evaluating evidence-based care to improve clinical outcomes. For the above

project in an acute hospital setting, best evidence for stroke related depression was reviewed to create an education module and quiz for the NSRNs to complete prior to beginning their new role in screening for depression. It was imperative that each NSRN had taken the education and demonstrated the knowledge to further educate patients on depression after stroke.

The QI project was partially driven by the institution's plan for further expansion and growth of a future stroke care team. As a CSC, the neuroscience department aims to further expand its stroke care with the development of a stroke specific team in the future. Currently, the SCC has solely worked with the neurology and neurosurgery departments to develop stroke protocols and perform bedside education and interviews to collect data for stroke patients. Part of this data included delivery of the PHQ-9 to patients to screen for depression. Although a single task, depression screening can be completed by several different health providers including nurses. Previously, there had been attempts with having the social work department complete the screenings. Unfortunately, like the SCC, social workers were not always available during the weekend hours and consistency in screening was lacking and the process failed to show any promise.

Nurses are with patients throughout the entire week and provide most of the bedside interaction with patients and families. The transition of the role for depression screening from the SCC to the NSRNs had been something anticipated but never fully formed until now. The PHQ-9 intervention for the project is going to continue as an ongoing process for the NSRNs. Using feedback provided by the NSRNs regarding the new task as well as the overall data regarding incidence of depression, future changes may be considered to improve the process and care including: A different or additional screening tool that also has the ability to assess for aphasic patients, better EMR recording with electronic prompts and reminders, improved notification to attending physicians when scores warrant further work-up, and the addition of a protocol with practice recommendations for treatment to guide the physicians as needed.

Dissemination

As previously noted, the current Hospital implements PSD screening as a part of their system's metrics and recommendations under AHA and ASA's guidelines. Despite the intervention being institutionally driven and recommended by the AHA and ASA, many other acute inpatient hospital systems could benefit from the dissemination of the evidence. Other hospitals systems that want to better

understand the importance of PSD screening in the immediate poststroke setting may benefit from the above outcomes. In addition, outpatient clinics could use inpatient evidence to better understand the prevalence of depression being observed in the acute setting. Although the direct process of screening through the RN staff would be mostly impactful during a similar inpatient setting, any venue of healthcare that encounters stroke patients can use these results to better understand depression after stroke. As the Hospital's results did not correlate with the current knowledge that 1/3rd of stroke patients develop stroke, it is possible that many of these patients may still develop depression later in their recovery.

As the new process develops, PSD screening will be conducted by all RNs who take care of stroke patients in the hospital. Though these other units have yet to take part in the new process, dissemination of the results would bring awareness about the screening process and introduce the intervention for future implementation. Last, the Hospital's chief nursing officer (CNO) and administration, unit coordinators, all RNs, and National Guidelines like the AHA and ASA would benefit from such findings that demonstrate PSD may not be as frequently observed or as definitive as a diagnosis in the immediate poststroke setting. Findings like the above project have the potential to influence not only policy within a single hospital but also National guidelines to better inform healthcare.

Figure 1. Evaluation Table of Literature

First Author (year)	*Design Methods*	*Sample Setting*	*Variables Studied*	*Measurement*	*Data Analysis*	*Overall Appraisal*
Burton (2015)	Level 1 SR	30 Publications and 27 screening tools	**IV:** Several screening tools used to assess for mood disorders **DV:** Patients receiving a particular screening tool	**(a)** Time to administer and score the measure: ≤5 min (score 2); 6–10 min (score 1); ≤11 min (score 0). **(b)** Initial costs for purchase of the measure (e.g. starter kit including manual): 2 = freely available; 1 = cost < £100; 0 = cost ≥£100 or unavailable. **(c)** Additional cost per record form: 1 = no additional Costs; 0 = additional cost or unavailable. **(d)** Need for specialist training to administer and score the measure: 1 = no specialist training required; 0 = specialist training required.	Extracted data from the participant samples, settings, selection criteria, tools tested, type of disorder assessed and sensitivity (≥0.8) and specificity (≥0.6).	Demonstrates valid use for PHQ-9; Also adds support for investigating better alternatives in stroke patients.
Hirata (2016)	Level 4 NHANES survey samples- MCD.	17,132 samples 2005-2010 678= Stroke Survivors 546= Completed PHQ-9 87 "Neighbors" depression group or prototype non-depression group	**IV:** Forest Model **DV:** Those surveyed in NHANES	Stroke was self-reported. Depression defined with PHQ-9 score > 10.	2 Logistic Regression Models: sociodemographic factors and Major Medical Comorbidities	Good evidence for examining predictors of depression in stroke; Uses PHQ screening.
Meader (2014)	Level 1 MA	24 studies on 2,907 stroke surviving participants	**IV:** PHQ-9 **DV:** Stroke Patients	Validation of: BDI, PHQ-9, PHQ-2, two stem questions, GHQ-12, GHQ-28, CES-D, GDS, GDS-15, Zung depression self-rating scale, HADS-D, and HDRS.	Bivariate & HSROC Meta-An were conducted using R 2.15.1 using the MADA and HSROC packages.	Validates PHQ-9 is suited well for screening stroke depression but always recommend f/u w/ psych.
Rogers (2017)	Level 5 Review	None	**IV:** 3 primary useful tools: PHQ-9, CES-D and HDRS **DV:** Stroke Patients	N/A	No analysis due to review	PHQ-2 best for RNs as it can be administered quickly and is followed by PHQ-9 if the initial screen is positive. Only a review paper and not definitive research.
Berg (2018)	Level 4 Retro and prospective pre and post review	2010: 105 stroke patients-MR's used to assess 2012: 112 Stroke patients-Nurse scored ward	**IV:** DEPS & Barthel Index **DV:** Stroke Patients in 2010 and 2012	Obs: 1) Obs only; 2) At least some discussion of depressive symptoms; 3) A screening Instrument; 4) Info. Received from a next of kin. 3 Points of measurement: 1) inpatient stay; 2) Outpatient < 9 months; 3) Outpatient between 9-18 months poststroke	Person's chi-squared to compare samples 2010 and 2012; t-Tests used to compare means and Mann-Whitney U Tests when necessary	Demonstrates the value in assessment and scheduling a f/u when flagged by an initial score
DeMan-van Ginkel (2012)	Observational, longitudinal, quantitative Level 3	2012: 53 stroke patients and 43 nurses.	**IV:** PHQ-9 **DV:** Stroke patients with ICH or IS	-0 to 4= no depression, 5 to 9= mild depression, 10 to 14= moderate depression, 15 to 19= moderately severe depression, 20 to 27= severe depression. -PHQ-9 and the PHQ-2 showed excellent results with respective sensitivities of 91% and 83% and respective specificities of 89% and 84% for major depression.	The interrater reliability test, Y-retest reliability and internal consistency of the PHQ-9 were good. Concurrent validity was moderate. -Optimal cut-off score 10.	RNs provided screening adequately as evidenced by good clinical utility. 93-100% of RNs believed the 10.7 minute time frame for administering PHQ-9 was acceptable and easy to use.
Wang (2018)	CC Level 3	147 Patients/self reported stroke 2015 Heart and Soul Study	**IV:** CES-D, PHQ-2 and 9, and Whooley Questions **DV:** HAS Patients	C-DIS used to diagnose depression and administered same day as screening tests with administrator blinded to results. Other measures like age, race, education, social history, income and medical history were self-reported.	Baseline characteristics among participants with and w/out depression compared with t-Tests, X^2 for binary or categorical variables and Fisher exact test for sample sizes ≤ 5.	Success with PHQ-9, but they deemed Whooley questions best at identifying depression.
Li (2016)	CC level 3	410 Chinese Stroke patients within 7-14 days poststroke	**IV:** PSD Early Depression Measure (35-item) self-rated scale **DV:** 410 patients with stroke	Demographic and clinical characteristics; 35-item PSD early depression measure-5 point Likert response 0-4 for each item	Descriptive: Freq. Stats with percentages for categorical var., mean and STD for continuous var.	Well developed, reliable data regarding the particular 35-item detection tool. -No PHQ-9

					EFA and CFA procedure used to evaluate the measure's factor structure and construct validity.	
Karamchandani (2015)	RCC level 3	158 patients admitted between 02/01/2013 and 04/15/2013 with no medical condition precluding screening.	**IV:** MPHQ-9 **DV:** 158 patients	PHQ-9 modified to examine depressive symptoms since hospitalization. Social workers implemented screening. Further assessment warranted if scores > 4. Measuring overall responses.	Descriptive stats for all patients were presented as frequencies for nominal and categorical data. Univariable and multivariable logistic regression determined factors associated with MPHQ-9 screening (P<0.2).	-PHQ-9 able to identify PSD, but the threshold score was arbitrary and more than a 1/4 of patients were not screened.
McIntosh (2017)	RCR Level 4	79 convenience sampled patients with acute stroke	**IV:** PHQ-9 **DV:** Stroke Patients	Recordings of patient responses from the chart review. Audits included collection of pt. Age, race, gender, comorbid conditions, type of stroke, PHQ-9 score and depression severity.	Parametric stats used to test for relationships among variables. Combo of descriptive, nonparametric, and parametric stats. Person's chi-squared analysis was used to test the association between PSD, demographic data, stroke characteristics, medical history, PHQ-9 category and protocol variables.	PHQ-9 good to determine depression in stroke patients when implemented by nurses. However, only 2 months were conducted, and a different hospitalist was on the unit each week possibly failing to communicate the proper protocol to implement.
Lewin-Richter (2015)	LCS level 3	96 inpatient rehab stroke patients at baseline. 71 of the original 96 present after 6 months for study	**IV**: GDS-15 and SCID **DV:** Stroke Patients	Baseline GDS-15 measured with ≥5 depicting DS; At 6-month f/u, reassessment of DS using GDS-15 over telephone.	Forward logistical regression analysis used to determine the predictive value of GDS-15. A two-tailed p-value <0.05 indicated statistical significance.	Did not use PHQ-9 and Hem. Stroke pts. were excluded. Pts. first assessed in inpatient rehab, not acute phase like my project is focused.
Dajpratham (2020)	Level 3	115 stroke patients (63 male and 52 female) ≥ 45 yrs old; first time stroke; stroke duration 2 weeks-2 years; adequate cognitive health and Thai speaking;	**IV:** Thai PHQ-9 and psychiatric interview (Psych interviewer blind to PHQ-9 score)—Both given same day **DV:** Stoke Patients- Normal and depressive Groups	Thai PHQ-9; Cut-off score ≥ 9 signified MDD (sensitivity= 0.84 and specificity= 0.77); Cut-off score ≥ 6 for depression diagnosis.	PHQ-9 scores and stroke duration calculated by Mann-Whitney U test; t-test compare depression group vs. normal group scores (p value < 0.05);	PHQ-9 to accurately predict PSD compared to standard psych interview. RNs to be able to use PHQ-9 as opposed to psych evaluation

LEGEND: *IV= Independent Variable; DV= Dependent Variable; (M)PHQ-9 (2 or 8)= (Modified) Patient Health Questionnaire; MCD= Multiprobability Cluster Design; MR= Medical Record; LCS= Longitudinal Cohort Study; NHANES= National Health and Nutrition Examination Survey; C-DIS= National Institute of Mental Health Diagnostic Interview Schedule; PSD= Poststroke Depression; BMI= Body Mass Index; MA= Meta-analysis; SR= Systematic Review; GHQ-12 (28)= General Health Questionnaire; CES-D= Center of Epidemiological Studies-Depression Scale; GDS (15)= Geriatric Depression Scale; HADS-D= Hospital Anxiety Depression Scale; HDRS= Hamilton Depression Rating Scale; HSROC= Hierarchical summary receiver operating characteristic; MADA= Meta-analysis of Diagnostic Accuracy; DEPS= Depression Scale; CC= Case Control; STD= Standard Deviation; EFA= Exploratory Factor Analysis; CFA= Confirmatory Factor Analysis; RCC= Retrospective Case Control; IS= Ischemic Stroke; ICH= Intracranial Hemorrhage; RCR= Retrospective Chart Review; DS= Depression Symptoms; DSM-IV= Diagnostic and Statistical Manual of Mental Disorders;MDD= Major Depressive Disorder; AUC= Area under the curve; DD= Depressive Disorder; AD= Adjustment Disorder*

Figure 2. Synthesis Table.
In poststroke patients (P), how does the implementation of the PHQ-9 depression screening tool through the nursing staff (I) compared to implementation through the stroke care coordinator (C), affect depression screening compliance (O)?

Author	*LOE/Design*	*# Participants*	*Pertinent Characteristic*	*Intervention*	*Major Findings*	
Burton (2015)	1/SR	30 pubs, 27 screening tools	Scored measurements regarding time to deliver screen, costs, and personnel to identify best overall tool	Several screening tools used to assess for mood disorders	PHQ-9: Adequate tool for PSD but sensitivity drops to 78% when trying to examine milder symptoms. Effective alternatives exist as well.	↑
Hirata (2016)	4/MCD	87 from NHANES	Forest Model used to identify 10 characteristics associated with PSD	Forest Model for PSD	17% stroke survivors encounter PSD	↔
Meader (2014)	1/MA	24 studies on 2,907 stroke survivors	Examined 24 studies on 2,907 poststroke patients	PHQ-9	PHQ-9: (sensitivity: 0.86; 95% CI 0.70 to 0.94; specificity: 0.79; 95% CI 0.60 to 0.90). Always follow up with psychiatric professional if flagged.	↑
Rogers (2017)	5/Lit. Review.	None-Simple review	Nursing focused assessment of PHQ-9 and other screening uses.	3 primary useful tools: PHQ-9, CES-D and HDRS.	PHQ-2: best for RNs d/t efficiency; PHQ-9 only if warranted.	↑
Berg (2018)	4/Retro and Pros. Review.	2010: 105 stroke patients- MR's used to assess 2012: 112 Stroke patients- Nurse scored ward	Examines 3 time point for measure of PSD observations along with 4 points of observation regarding PSD	DEPS & Barthel Index	2010: < 50% of patients had any mood recorded; 2012: > 80% had mood recordings due to follow-ups and increased detection. F/U important.	↔
de Man-van Ginkel (2012)	3/Obs.Long. Quant.	2012: 55 patients provided with PHQ-9	Determined Cut-off scoring points for depression and clinical utility	PHQ-9	To study clinical usefulness/quality of different instruments. PHQ-9 has best clinical utility.	↔
Wang (2018)	3/CC	147 reports from Heart and Soul study	Used C-DIS to officially diagnose depression same day as screening	CES-D, PHQ-2 and 9, and Whooley Questions	Results demonstrated success with PHQ-9 but Whooley questions were deemed best at identifying depression.	↑
Li (2016)	3/CC	410 Chinese Stroke patients- 7-14 days poststroke	Goal to assess for PSD within 14 days of admission	PSD Early Depression Measure (35-item) self-rated scale	The researchers were able to identify PSD symptoms avg, 11 days poststroke.	↔
Karamchandani (2015)	3/RCC	158 stroke patients	Social worker-implemented modified PHQ-9	MPHQ-9	>1/3 of all IS and ICH patients screened positive for depression or >4.	↑
McIntosh (2017)	3/RCR	79 acute stroke patients	Chart Reviews: Highest % of identified PSD of all studies 48%	PHQ-9	PHQ-9 useful with nurses implementing but short time period and consistent management.	↑
Lewin-Richter (2015)	3/LCS	96 IRS patients at baseline. 71 IRS @ 6 months for study.	Only study to show PSD at inpatient rehab and also present at 6 months with significant percentage	GDS-15 and SCID	42.43% who scored above the cut-off on GDS-15 met DSM-IV criteria for depressive disorder at 6 months.	↔
Dajpratham (2020)	3/CC	115 stroke patients	Compares ability of PHQ-9 to detect depression against DSM-V criteria for diagnosis of depression	Thai PHQ-9	Thai PHQ-9 acceptable for detecting a mixture of MDD, AD, in stroke patients using summed-score based diagnosis for depression with cut-off score ≥ 6 signifying depression.	↑

LEGEND: *(M)PHQ-9 (2 or 8)= (Modified) Patient Health Questionnaire; MCD= Multiprobability Cluster Design; MR= Medical Record; LCS= Longitudinal Cohort Study; C-DIS= National Institute of Mental Health Diagnostic Interview Schedule NHANES= National Health and Nutrition Examination Survey; PSD= Poststroke Depression; MA= Meta-analysis; HDRS= Hamilton Depression Rating Scale; SR= Systematic Review; CES-D= Center of Epidemiological Studies-Depression Scale; GDS (15)= Geriatric Depression Scale; MADA= Meta-analysis of Diagnostic Accuracy; DEPS= Depression Scale; SCID= Structured Clinical Interview for DSM-5; CC= Case Control; CI= Confidence Interval; RCC= Retrospective Case Control; IS= Ischemic Stroke; ICH= Intracranial Hemorrhage; RCR= Retrospective Chart Review; DS= Depression Symptoms; DSM-IV= Diagnostic and Statistical Manual of Mental Disorders; MDD= Major depressive disorder; AD= Adjustment disorder; ↑=Increased Effect; ↔=No Effect*

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Table 1.

Title: Sample Characteristics (N=107) on Demographics

Table 1. Sample Characteristics (N=107) on Demographics	
Characteristic	**n (%)**
Male	18 (16.82)
Female	87 (81.31)
Non-Binary	1 (0.93)
Undisclosed	1 (0.93)
Age, years	
<26	26 (24.30)
26-30	29 (27.10)
31-40	27 (25.23)
41-50	19 (17.76)
51-60	5 (4.67)
> 60	1 (0.9)
Experience, years	
< 3	54 (50.57)
4-8	22 (20.56)
9-15	16 (14.95)
16-20	4 (3.74)
> 20	11 (10.28)
Employment Status	
Flex	8 (7.48)
Single Hospital Staff	97 (90.65)
Travel	2 (1.87)

Table 2.

Title: Comparison of PHQ-9 Screening Data between Pretest (2019) and posttest (2020)

Table 2. Comparison of PHQ-9 Screening Data between Pretest (2019) and posttest (2020)

Characteristic	**Pretest (2019) n= 172**	**Posttest (2020) n= 128**	***P* Values**	
Male, n (%)	74 (43)	64 (50)		
Female, n (%)	98 (56.9)	64 (50)		
NIME, n	73	63		
NPUE, n	75	46		
NIUE, n	24	19		
IS, n (%)	141 (81.9)	106 (82.8)		
ICH, n (%)	31 (18)	22 (17.2)		
Age-avg years, n	65	70		
Screened, n (%)	134 (77.9)	104 (81.25)	**0.56‡**	
Missed, n (%)	38 (22.1)	24 (18.8)		
UTA, n (%)	29 (16.9)	10 (7.8)		
Weekend Screened, n (%)	17 (63)	27 (87.1)	**0.08‡**	
Weekend Missed, n (%)	10 (37)	5 (15.6)		
Psych Referral, n (%)	8 (4.7)	6 (4.7)	**0.99‡**	
PHQ-9 Score-avg, n	NIME: 2.1 NPUE: 1.1 NIUE: 0 Overall: 1.05	NIME: 3.9 NPUE: 2.2 NIUE: 1.9 Overall: 2.6		
Scored > 4 on PHQ-9, n (%)	Yes: 13 (12.6) No: 90 (87.4)	Yes: 18 (22) No: 64 (78)	**0.11‡**	
Avg Day of Screening/Avg LOS, n	NIME: 1.5/3.87 NPUE: 3.4/5.37 NIUE: 9.4/11.4 Overall: 4.8/6.89	NIME: 1.8/3.42 NPUE: 2.2/4.15 NIUE: 4.2/7.1 Overall: 2.7/4.89		

‡ Chi-square test
NIME: Neuroscience intermediate care unit
NPUE: Neuroscience progressive care unit
NIUE: Neuroscience intensive care unit
UTA: Unable to assess due to aphasia, cognitive deficit etc…
IS: Ischemic Stroke
ICH: Intracranial Hemorrhage/Hemorrhagic Stroke
Note. For the overall patient population, patients discharged on weekends and status of scoring on the PHQ-9, the distribution of status of screening and referrals stratified by time relative to implementation of the intervention. Counts and column percentages are presented. Also presented are p values for exact Pearson chi square tests for differences in pre and post percentages.

Table 3.

Title: NSRN likert-scale Feedback

Table 3. NSRN Likert-scale Feedback					
NSRN Responses n= 85					
NSRN Statements n, (%)	1-Strongly Disagree	2-Disagree	3- Neutral	4- Agree	5- Strongly Agree
1) The PHQ-9 was easy to administer	1 (1.18)	4 (4.71)	29 (34.12)	43 (50.59)*	8 (9.41)
2) The PHQ-9 was beneficial to stroke care	1 (1.18)	3 (3.53)	26 (30.59)	45 (52.94)*	10 (11.76)
3) The PHQ-9 provided accurate results	1 (1.18)	2 (2.35)	40 (47.06)*	38 (44.71)	4 (4.71)
4) I felt prepared to deliver the PHQ-9	1 (1.18)	9 (10.59)	27 (31.76)	40 (47.06)*	8 (9.41)
5) I felt confident answering patient's questions about the PHQ-9	1 (1.18)	5 (5.88)	26 (30.59)	46 (54.12)*	7 (8.24)
6) I would recommend continued use of the PHQ-9	1 (1.18)	7 (8.24)	27 (31.76)	43 (50.59)*	7 (8.24)
NSRN: Neuroscience nursing staff *Denotes highest response from statement					

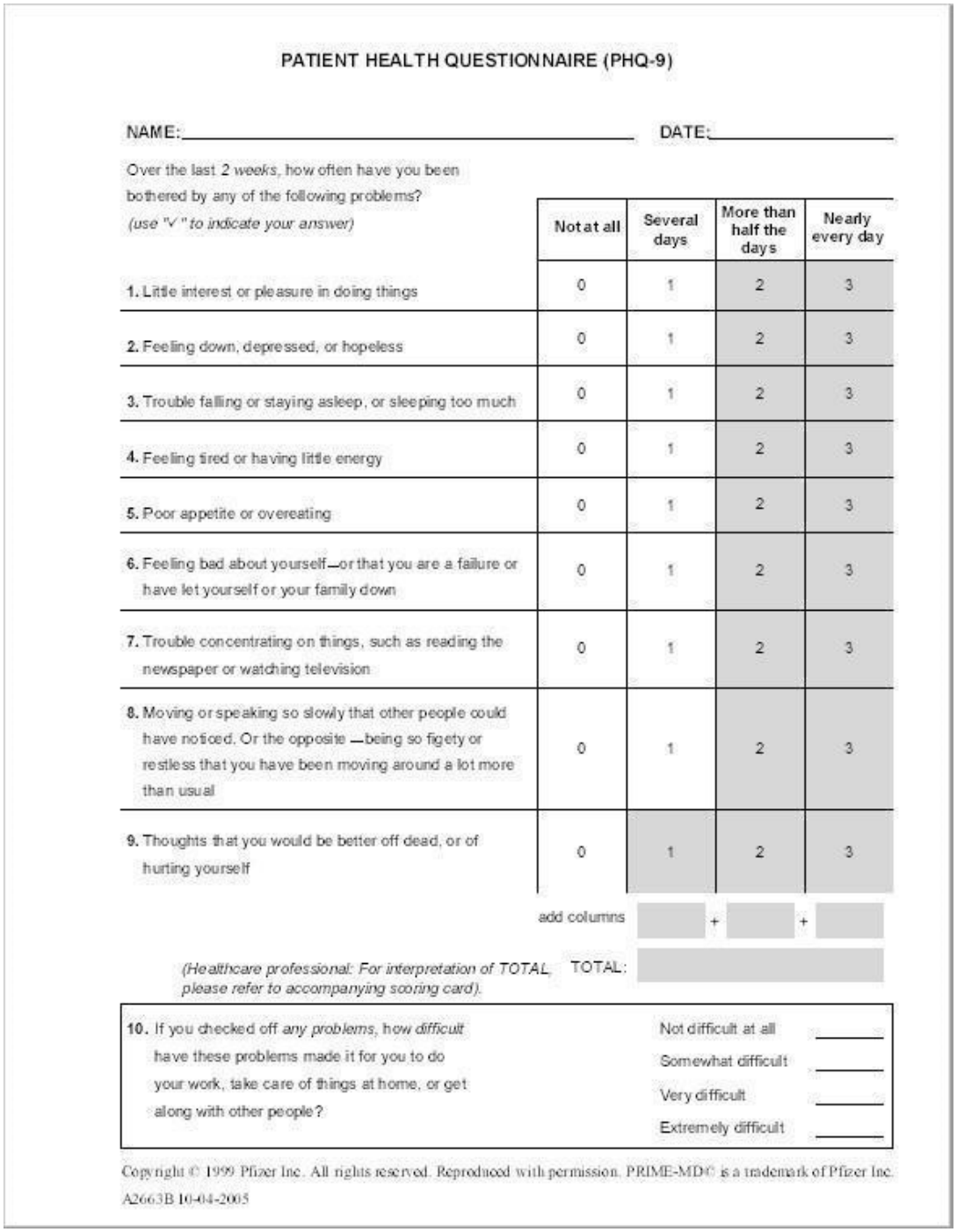
Table. 4

Title: NSRN Open-ended Qualitative Feedback

Table 4. NSRN Open-ended Qualitative Feedback
Total NSRN Responses: 85
n, (%)

1. Please explain any difficulties, frustrations, or any other problems that occurred while implementing the PHQ-9.							
No difficulties/No Response	**Overburdened/ time consuming**	**Overwhelming d/t COVID**	**Difficult d/t patient reasons**	**Not necessary d/t night shift**	**Protocol itself/Notifying Physicians**	**Education: not enough or unnecessary**	**Not yet completed PHQ-9 on patient**
*57 (67.1)	9 (10.6)	3 (3.5	7 (8.2)	2 (2.4)	1 (1.2)	2 (2.4)	4 (4.7)
2. Please explain any alternatives to how the PHQ-9 should be implemented or provide any suggestions to improve upon the new intervention.							
No alternatives/ No Response	**Request alteration of EMR**	**Recommend using other personnel**	**More Education**	**Only completed on designated day**	**Used on all patients**	**Request an alternative tool be used**	
*68 (80)	4 (4.7)	Other entirely: 5 (5.9) Combo: 2 (3.5%)	1 (1.2%)	1 (1.2%)	1 (1.2%)	3 (3.5%)	

NSRN: Neuroscience nursing staff
*Denotes highest response total.



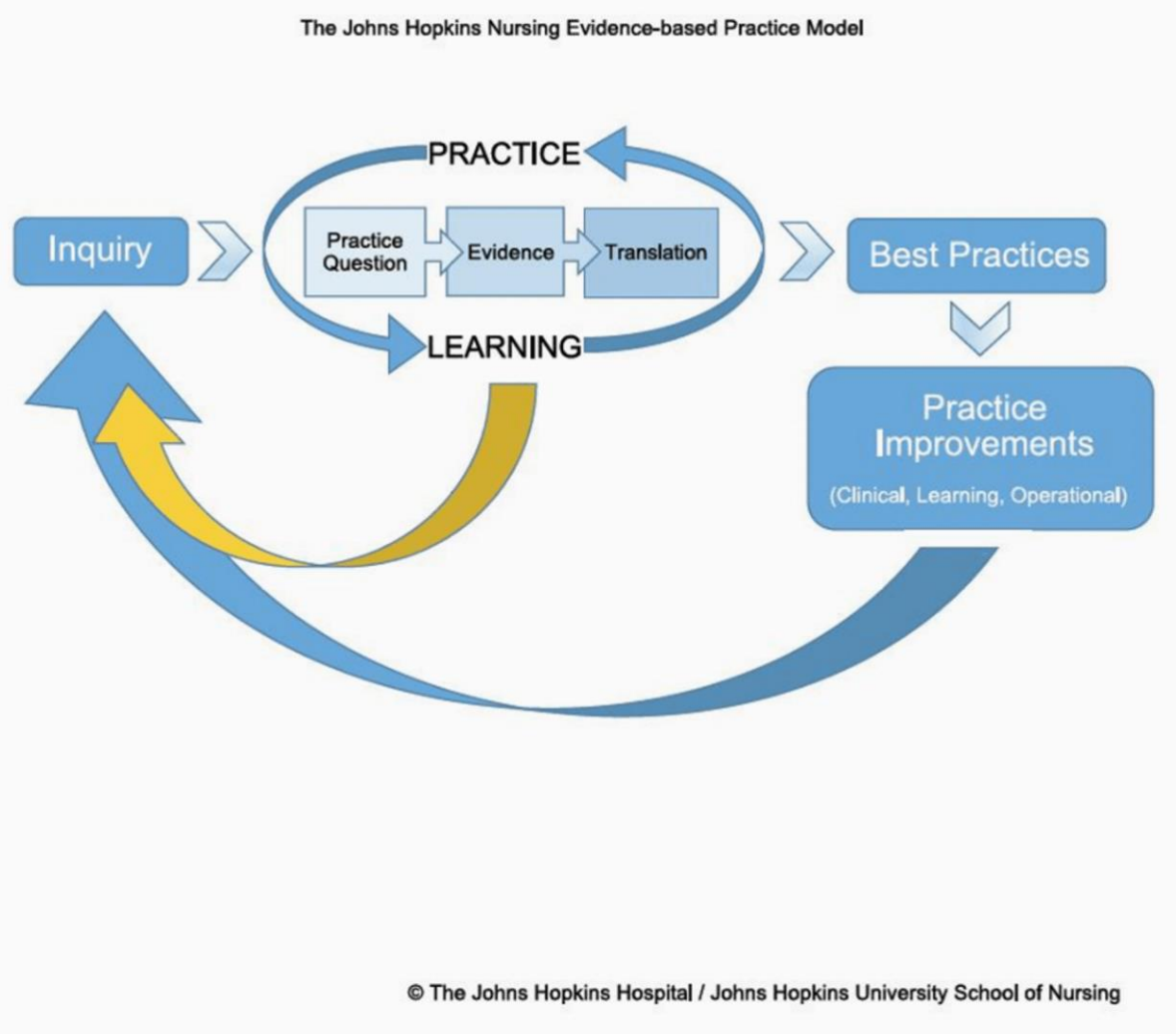
PATIENT HEALTH QUESTIONNAIRE (PHQ-9)

NAME:_____ DATE:_____

Over the last 2 weeks, how often have you been bothered by any of the following problems? *(use "√" to indicate your answer)*	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself—or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed. Or the opposite —being so figety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead, or of hurting yourself	0	1	2	3
	add columns	+	+	
(Healthcare professional: For interpretation of TOTAL, please refer to accompanying scoring card).	TOTAL:			

10. If you checked off *any problems*, how *difficult* have these problems made it for you to do your work, take care of things at home, or get along with other people?	Not difficult at all _____ Somewhat difficult _____ Very difficult _____ Extremely difficult _____

Appendix A. PHQ-9 Questionnaire Sample (National University of Natural Medicine, 2018).

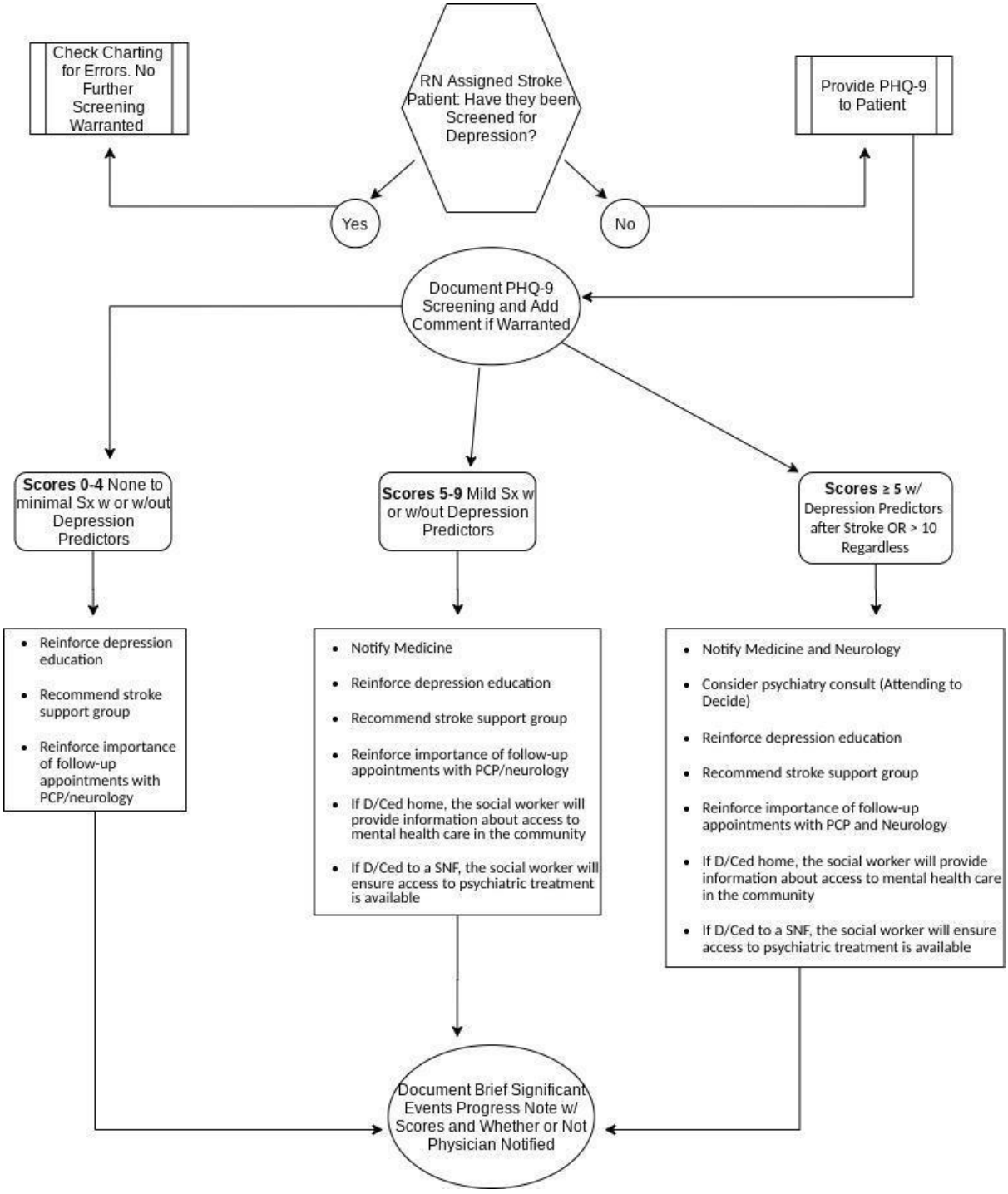


Appendix B. The Johns Hopkins Nursing Evidence-based Practice Model (JHNEBP) (Dang & Dearholt, 2017).

Domain 1. Scope and purpose	
Item 1	The overall objective(s) of the guideline is (are) specifically described
Item 2	The health question(s) covered by the guideline is (are) specifically described
Item 3	The population (patients, public, etc.) to whom the guideline is meant to apply is specifically described.
Domain 2: Stakeholder involvement	
Item 4	The guideline development group includes individuals from all the relevant professional groups.
Item 5	The views and preferences of the target population (patients, public, etc.) have been sought.
Item 6	The target users of the guideline are clearly defined.
Domain 3: Rigor of development	
Item 7	Systematic methods were used to search for evidence.
Item 8	The criteria for selecting the evidence are clearly described.
Item 9	The strengths and limitations of the body of evidence are clearly described.
Item 10	The methods for formulating the recommendations are clearly described.
Item 11	The health benefits, side effects, and risks have been considered in formulating the recommendations.
Item 12	There is an explicit link between the recommendations and the supporting evidence.
Item 13	The guideline has been externally reviewed by experts prior to its publication.
Item 14	A procedure for updating the guideline is provided.
Domain 4: Clarity of presentation	
Item 15	The recommendations are specific and unambiguous.
Item 16	The different options for management of the condition or health issue are clearly presented.
Item 17	Key recommendations are easily identifiable.
Domain 5: Applicability	
Item 18	The guideline describes facilitators and barriers to its application.
Item 19	The guideline provides advice and/or tools on how the recommendations can be put into practice.
Item 20	The potential resource implications of applying the recommendations have been considered.
Item 21	The guideline presents monitoring and/or auditing criteria.
Domain 6: Editorial independence	
Item 22	The views of the funding body have not influenced the content of the guideline.
Item 23	Competing interests of guideline development group members have been recorded and addressed.

Appendix C. Agree II item for scoring guidelines (Agree II, 2009).

Appendix D. The Tidal Model (Barker and Buchanan-Barker, 2010).



Appendix E. PHQ-9 score driven algorithm for NSRN.